

We claim:

1. A method for controlling a process of applying a developer solution onto a substrate using a spin-coating apparatus, the method comprising:
 - controlling the process using serial process control wherein the process is controlled by sequentially executing a series of subroutines;
 - interrupting the serial process control with an interrupt signal to execute a process command.
2. The method of claim 1 wherein the interrupt signal is sent to a central processing unit of the process control system, and wherein upon receiving the interrupt signal the central processing unit executes an interrupt service routine.
3. The method of claim 2 wherein the interrupt service routine starts multiple timers, each timer measures a different duration, and at the end of each duration the interrupt service routine sends an interrupt signal to the central processing unit and the central processing unit executes a process command.
4. The method of claim 1 wherein after executing the process command, the process control system returns to serial process control until it receives another interrupt signal.
5. The method of claim 1 wherein the interrupt signal is a software interrupt signal.
6. The method of claim 1 wherein the interrupt signal is a hardware interrupt.
7. The method of claim 6 wherein the hardware interrupt signal is sent from a supply system controller upon occurrence of a start of solution dispense or an end of solution dispense, or both.
8. The method of claim 1 wherein the process command is chosen from a start of turntable acceleration or deceleration, and a start of a dispenser movement.
9. A method for providing a photoresist coating onto a substrate, the method comprising:

spin-coating a photoresist solution onto the substrate wherein the spin-coating process is controlled by a method comprising:

controlling the process using serial process control sequentially executing a series of subroutines;

interrupting the serial process control with an interrupt signal to execute a process command; and

applying a developer solution onto the spin-coated photoresist using a spin-coating apparatus wherein the spin-coating apparatus is controlled by a method comprising:

controlling the process using serial process control sequentially executing a series of subroutines; and

interrupting the serial process control with an interrupt signal to execute a process command.

10. A method of spin-coating a developing solution onto a microelectronic device, the method comprising executing process commands at durations measured in parallel from an earlier process event.

11. The method of claim 10 wherein two or more durations are measured from a single process event to control the timing of two or more process commands.

12. The method of claim 10 wherein each duration is controlled to within 5 milliseconds.

13. The method of claim 10 wherein each duration is controlled to within 1 millisecond.

14. The method of claim 10 wherein

duration D4 is measured from time t_0 ;

at the end of duration D4, a first process command is executed; and

duration D5 is measured in parallel with D1 from time t_0 ; and

at the end of duration D5, a second process command is executed.

15. The method of claim 10 wherein the process event involves a hardware interrupt.

16. The method of claim 15 wherein the hardware interrupt relates to a process event chosen from the group consisting of: a beginning of a dispenser movement into dispensing position; an end of a dispenser movement into dispensing position; a beginning of a solution dispense; an end of a solution dispense; a beginning of dispenser movement out of dispensing position; and an end of dispenser movement out of dispensing position.
17. The method of claim 10 wherein at least one of the process commands is chosen from the group consisting of: a start of dispenser movement; a start of dispense of a developer solution; an end of dispense of the developer solution; a change of turntable spin acceleration or deceleration.
18. The method of claim 14 wherein durations D4 and D5 are measured using two different timers.
19. The method of claim 18 wherein the timers are accurate to within 5 milliseconds.
20. The method of claim 18 wherein the timers are accurate to within 1 millisecond.
21. A method of controlling a develop solution spin-coating process, the method comprising the use of a process control system programmed with an interrupt service routine, wherein upon a trigger event, a hardware interrupt is sent to the process control system, upon receipt of the hardware interrupt, the process control system executes an interrupt service routine, and wherein the interrupt service routine includes the steps of:
setting two or more timers to run in parallel for durations, and
sending a software interrupt at the end of each duration to interrupt the process control system and execute a process command.
22. A method of processing a microelectronic device, the method comprising the steps of:
spin-coating a processing solution onto a surface of the microelectronic device;
and

spin-coating a developing solution onto the microelectronic device, the spin-coating method comprising interrupting serial process control to execute a process command.

23. The method of claim 22 wherein spin-coating the processing solution involves executing a process command using interrupted process control.

24. The method of claim 22 wherein serial process control is interrupted using an interrupt signal which causes execution of an interrupt service routine.

25. The method of claim 24 wherein the interrupt service routine starts multiple timers, each timer measures a different duration, and at the end of each duration the interrupt service routine sends an interrupt signal to the process control system which executes a process command.

26. The method of claim 22 wherein the method avoids accumulation of timing variability in processing commands otherwise caused by serial timing methods.

27. A method of controlling a process for spin-coating a developer solution, the method comprising initiating two or more process commands at durations measured in parallel from one or more earlier process events, to avoid timing variabilities otherwise caused by serial timing methods.

28. A spin-coating apparatus comprising a process control system to control developer solution spin-coating steps comprising initiating process commands at durations measured in parallel from one or more earlier process events.

29. A spin-coating apparatus comprising:

a turntable to support and rotate a substrate;

a dispenser moveable between a dispensing position and a non-dispensing position;

a supply of developer solution in fluid communication with the dispenser;

a process control system to control application of the developer solution onto the substrate, the process control system being programmed to interrupt serial control to execute a process command.

30. A spin-coating device comprising a process control system programmed to execute developer solution spin-coating processing steps comprising timing different process commands in parallel using two or more timers, to avoid accumulation of timing variability in processing commands caused by serial timing methods.